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RE: THE GETTYSBURG ADDRESS REPRESENTING SOCIAL AND POLITICAL AC--ETC(U)  
JAN 78 R C SCHANK, J G CARBONELL  
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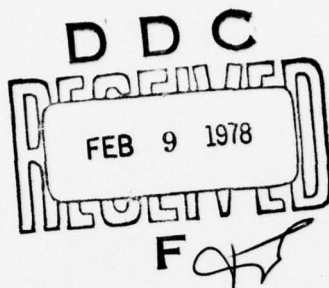


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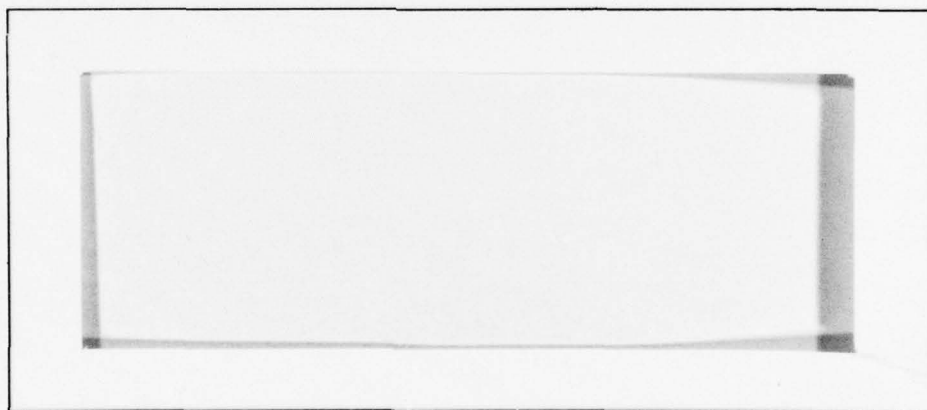
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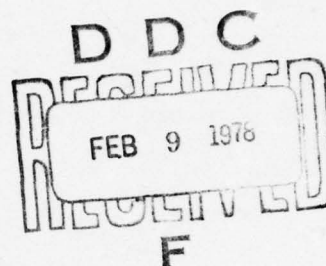


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Re: The Gettysburg Address  
Representing Social and Political Acts  
January 1978  
by  
Roger C. Schank & Jaime G. Carbonell, Jr.  
Research Report #127



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RE: THE GETTYSBURG ADDRESS

Representing Social and Political Acts

by

Roger C. Schank and Jaime G. Carbonell Jr.



#### Acknowledgement

The authors would like to acknowledge the following people: Danny Bobrow, who asked the question at IJCAI that got one of us (R.S.) to think about problems we had not tried to handle; Wendy Lehnert and Chris Riesbeck who had some helpful insights; and, most of all, Joe Weizenbaum, who came up to me (R.S.) during IJCAI and said how wonderful it was that I had admitted there were things that our systems couldn't do. I realized that what I meant by "couldn't" was "couldn't yet" and that this was probably not what he had in mind. Motivation comes in strange ways.

This work was done at the Yale Artificial Intelligence Project which is supported in part by the Advanced Research Projects Agency of The Department of Defense and monitored under the Office of Naval Research under contract N00014-75-C-1111.

# 1. Introduction

At the last AI conference, one of us (R.S.) was part of a panel on Knowledge Representation. The panel was asked to come prepared to discuss, among other things, problems that their systems found difficult or impossible to handle. For my part of the discussion, I suggested The Gettysburg Address was something that we hadn't the slightest idea how to handle.

Let us look at the beginning of the Gettysburg Address to see what kinds of problems we had in mind:

(1) Four score and seven years ago...

There is no real difficulty here. This is just a grandiose way of saying 87 years ago. Although certain stylistic problems do come up, e.g. "why do people say things in this way in speeches?" and certain artistic things come up, e.g., "is this a pretty way of saying 87 years ago?". for the most part, this first phrase is not a part of the difficulties we were referring to.

(2) Our forefathers brought forth on this continent a new nation...

The problems here are numerous:

(a) What is a "forefather?"

To understand the concept of forefather, it is necessary to understand time and process notions: metaphors about fatherhood being bestowed on ideas and political entities as well as its literal meaning; and the general world of politics.

(b) What does "brought forth" mean?

Clearly this has to do with creation of some sort. Again we have a metaphor for "birth" and "fatherhood", etc. However, ascribing this to metaphor in no way solves the problem. How do we represent creation? The simplest (and most tempting) answer is to have a static description, where first we have nothing and then we have something. This seems to miss something in the process of birth however. More importantly, can the birth of a nation be described this way? Certainly this is a very complicated idea (although perhaps no more complicated than the birth of a child).

(c) What is a nation?

Other than some simple rendering of a nation as \*nation\* or as type node in a semantic network, the concept of nation seems rather intractable. How do we deal with it?

(3) conceived in liberty,



Our birth metaphor continues on here. To analyze this we must understand how nations are like humans. We must also understand what liberty means. Saying something like "it means freedom" won't do. What are the primitive concepts by which we can get at ideas like this?

(4) and dedicated to the proposition,

Can a nation be dedicated? How does one dedicate it? Again, what does this really mean? It seems hard to even think about representing this in any Conceptual Dependency-like formal language. This is also in no way handlable using scripts. Certainly there is no DEDICATION script for example.

What is a proposition? In Conceptual Dependency it is any ACTOR-ACTION-OBJECT construction, but how do we represent references to it? Texts that talk about texts must be represented in a fashion different from the texts themselves.

(5) that all men are created equal

If we can understand how to represent propositions like (5) we can represent anything. This is not a script or a series of conceptualizations describing equality. It seems like a simple idea and should be represented simply. On the other hand, how many people would agree in any detail about the meaning of (5)? One man's equality is probably not another's.

(6) Now we are engaged in a great civil war.

What is war? If we can really understand what war involves we might be able to write a WAR script, but would that capture the purposes and aims of war? Who does the "we" refer to? Unless the concepts of war and nation are well understood it becomes extremely difficult to disambiguate the referent. For instance Charniak's (1972) heuristics are totally inapplicable.

In all the above kinds of problems one thing seems clear. What we have had in Conceptual Dependency is a system for describing the physical world. Scripts, plans and goals allowed us to look at the intentions and knowledge behind these physical events. What we need to handle a problem such as those found in the Gettysburg Address (though one would have no trouble finding them in a newspaper everyday) is a system for representing social and political actions and the knowledge and intentions underlying them. Such a system might parallel Conceptual Dependency in interesting ways, but it would not be identical to it. It is such a system that we shall seek to develop in this paper.

## 2. Triangles

Sometimes when you read a newspaper it is possible to read only the headline and feel safe in ignoring the story. Although a headline is rather short it often can convey nearly the entire story, at least by inference. Below are some headlines taken

from the New York Times that illustrate my point:

- 1 - Catawba Indians Land Claim Supported.
- 2 - Integration Plan Deadline Met By Boards In Ohio.
- 3 - Lehigh University Uncovers Payments By Students To Alter Grades.

It is really not necessary to have read the stories underneath these headlines in order to know what the stories must have said. We can fill in the details of the stories ourselves. How?

Let us first point out that scripts do not solve the problem here. Scripts are a kind of knowledge structure meant to describe sequential events that are much more commonplace than land-claims or grade altering schemas. If we start admitting such things into the world of scripts we essentially destroy the value of scripts by creating too many of them, thus making the process of searching for appropriate ones extremely cumbersome. Indian land claims and grade altering schemas are neither stereotypical, nor are they well defined in terms of exactly what happens when they take place. We understand a grade altering schema more by its effects and likely consequences than by the precise method employed in altering the grades. Hence, it is not the sequential events described in a scrip that are of primary interest to the understander.

We have adopted, as a more general kind of knowledge structure, applicable where scripts are not, an elaborate scheme of plans, goals and themes (see Schank and Abelson, 1977). But this system too is inadequate to the task of rendering headlines into stories, this time for the opposite reason: that apparatus is too general to apply to the specific knowledge we use in these situations. We would not want to ask questions such as: what general goal did the Catawba Indians have in mind and what plan did they use to solve it? We really already know the answer to that in some detail. But from what?

The method by which we can fill in the details of headlines such as those given above is derived from our knowledge about socio-political situations. A child or a person naive in politics or social organizations would have a great deal of difficulty discerning anything of substance from the above headlines. On the other hand, the more knowledgeable one is in the general method by which societies operate, the easier it is to fill in the details. What we need then, is a general apparatus for describing socio-political organizations and situations from which details of specific situations can be inferred.

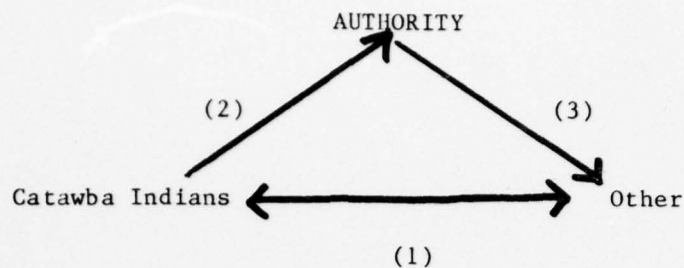
Lets begin by looking at sentence (1) - "Catawba Indians land claim supported." The problem here is what exactly "land claim" and "supported" mean in a more general sociological point of view. That is, we know that a land claim is more than what we might use to represent it in Conceptual Dependency.



Something like "Indians MTRANS land be possessed by Indians" is possibly true, but it misses the point. A "land claim" is in a sense a petition to a higher authority to resolve a dispute between two parties. That is, the Indians are saying to the U.S. Government, "this land is ours". It may not be possible to infer the particulars of this land claim. Indians have been known to take the land by force, to file documents in government offices, to complain to newsmen and so on. The important point here is that we really need not know, and in most cases a reader would not bother to worry about, exactly which method has been selected. Rather, a reader feels that he understands the story when he has been able to identify the relationships and aims of the parties involved.

In the case of sentence (1) we can establish that a "land claim" is a type of petition to a higher authority to resolve a dispute about land ownership. We do not know who presently owns the land, but we know enough about ownership of property to infer that there is probably a counter petition of some sort. We also know about petitions to authority. They usually get resolved by the authority. In this case then "supported" refers to the decision of the authority in the case.

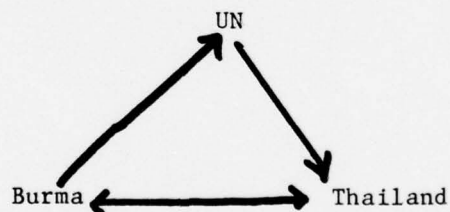
This information can be represented graphically by a kind of triangle:



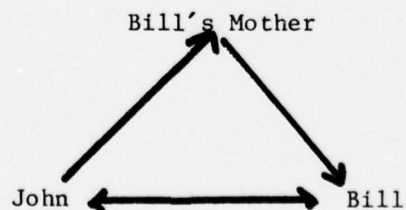
In this triangle (1) separates the dispute between the Indians and the owners of the land, (2) represents the appeal to authority to resolve the dispute made by the Indians, and (3) represents the authority's decision.

Triangles of this sort have use in representing any type of dispute. For example, in (4) and (5) such triangles can also be constructed:

(4) Burma appeals to UN to settle border dispute with Thailand.



(5) John complained to Bill's mother that Bill hit him.



Of course, these triangles just suggest the basic relationships involved. In order to add substance to the bare bones of the triangles we shall have to start discussing some representational issues that are being glossed over here. The important point at this juncture is that there is an essential similarity across (1), (4) and (5) that the similarity must be represented in some way, and that that similarity can be exploited for use in an understanding system.

### 3. SOCIAL ACTs

The first representational problem we encounter in trying to make explicit much of what is implicit in the triangle representation is that we will need to design a new set of ACTs to take care of the various relationships.

In the primitive ACTs of Conceptual Dependency we have a system that represents physical actions by using a small set of basic actions that can combine in various ways to describe detailed or complex actions that underlie seemingly simple verbs and nouns. The primitive ACTs do not account for intentionality and goals underlying physical action. To account for such things we devised a complex apparatus discussed in Schank and Abelson (1977). It should come as no surprise then that if we wish to account for social events, we will need a system of basic social ACTs to represent the social actions that comprise the events. We term these "basic social ACTs" rather than primitive ACTs



because in the end most social ACTs have some physical manifestation, which are, however, of little relevance in representing socio-political interactions. For example, a government decision to resolve a dispute may be MTRANSed in a variety of ways to the several different parties concerned. The various details of the MTRANS or any of instrumental acts have little relevance to the social or political consequences of the government decision, which usually are of primary interest; the inferences resulting from the MTRANS (i.e. the actor of the MTRANS must have previously known the information he MTRANSed to the recipient. The recipient now has the new information) are true but of lesser significance than the inferences that can be drawn from the government decision itself. These inferences include the following: There must have been a dispute between two parties. One of the two parties probably asked the government to resolve their dispute. The dispute was probably resolved as a result of the governmental decision. The government is likely to enforce its decision if the parties concerned do not abide by the decision.

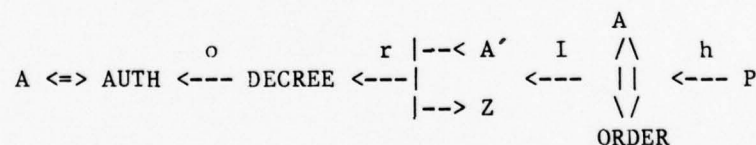
The most significant inference to be made from an authority's decision is that simply by virtue of that decision something has actually happened. That is, a government authorization is a truly performative ACT. Thus, if the government says some property is mine or that a man is a criminal, then it is so by virtue of their saying it. Similarly other authority figures have the same power. A professor can say a thesis is finished and a student has a Ph.D. and these things

are the case by virtue of him saying it.

Not all authority's decisions are like this to be sure. Sometimes an authority gives an order and that order must be carried out for the decision to have effect. Frequently these orders come about as a result of a governmental decision or authorization. If the government says the land belongs to the Catawba Indians, then it does, but they may have to send in the National Guard to get the original owner off the property.

What we are proposing then is two basic social ACTs - AUTHORIZE (abbreviated AUTH) and ORDER. AUTH is something only an authority can do. This is actually a circular definition, since if one can AUTH then that defines one as an authority. In a sense, an authority is one whose AUTHs are recognized as legitimate by the parties involved, or one who has the power to effectively enforce his AUTHs with corresponding ORDERS.

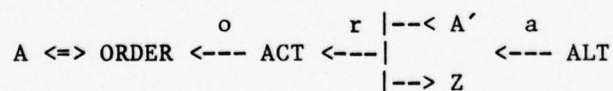
We can diagram AUTH as follows:



A is the authority which can AUTHorize a DECREE. A DECREE is a statement about the state of the world, affecting the recipient Z, that is true by virtue of it being AUTHed. Usually an AUTH signifies a change from the previous state of the world. The recipient can be a specific person, the parties involved in a dispute, or an entire nation (if A is a government). A' is

the "real" authority on whose behalf A AUTHorizes the decree. For instance, a judge often AUTHorizes on behalf of the court; a business executive AUTHorizes on behalf of his company. It is often the case that  $A = A'$ . P is a measure of the relative degree of authority which A is able to exercise over Z, measured in a scale of 0 to 10 for convenience. The AUTHs of dictatorial government over its citizens would all have  $P = 10$  for example. On the other hand an AUTH of the United Nations General Assembly over individual countries involved in a dispute would be more like  $P = 4$ . The social act ORDER often fills the instrumental case of an AUTH.

ORDER is a frequent inference of AUTH. The government can AUTH its army to fight a war, by means of declaring war on another country, but that doesn't, simply by virtue of the statement, imply that the army is fighting the war. A subsequent ORDER to the armed forces is required that carries with it the implicit punishments that are relevant in not carrying out an order. We diagram the ACT ORDER as follows:



The conceptual cases  $A'$  and Z are the exact same ones of the AUTH which preceded the ORDER. In a government or any other hierarchical social structure, a lower authority may enforce the AUTH of a higher authority ( $A'$ ) via an ORDER. In other cases the A who AUTHs is the same A who ORDERS. The ACT case of an ORDER

is some action or sequence of actions carried out by the recipient (Z) in order to bring about the desired state of the world (the DECREE of the previous AUTH). ALT is the alternative open to Z if he decides not do the ACT. ALT is usually a punishment, often left implicit in the ORDER, hence it is an optional case of ORDER.

We might ask at this point why can't we do these things with the CD primitives we now have? What is the advantage of these new ACTs? To answer these questions, we need to look at the purpose of a primitive ACT. It is possible to represent ORDER in CD for example. The verb 'order' means to MTRANS to someone that if they do not do a particular action or sequence of actions then that will cause the actor of the MTRANS to do some other (unspecified) action whose result will be a negative state change on the part of the recipient of the MTRANS and that this negative state change will cause the recipient to be more unhappy than any consequent state changes resulting from performing the MTRANSed acts. It must also be MTRANSed that if the MTRANS recipient does carry out the specified act(s) then the MTRANS actor will not do the action(s) resulting in a negative state change to the recipient. This representation is quite complete but extremely cumbersome. Is it necessary that we think of all the explicit details each time that we understand an 'order' to have taken place?



The same question can be asked with respect to 'authorize'. We understand what authorization or governmental decision is, but we need not access all that information each time we understand the word. Consider the problem of explaining the meaning of these words to a child for example. It is very difficult to explain them precisely because they are so complicated at the level of physical primitive ACTs. Yet these ideas are really not complicated at all at a social level of ACTs. Such simple concepts such as ORDER and AUTHORIZE form the basis of the organization of societies. What is complex at one level is simple at another. This idea of nested levels of complexity, each with its own set of primitives, is a very important one for the representation of information in artificial intelligence. By choosing a good set of primitives we can effectively organize what we need to know. Thus, ORDER and AUTHORIZE have inferences that come from them just as the physical primitive ACTs do. The main difference is that these basic social ACTs are not primitive in the same sense. They can be broken down, but we would rarely choose to do so.

The use of these new basic ACTs is much like the use of the original primitive ACTs. We can predict what will fill slots reasonably in a conceptualization and make inferences about slot fillers and consequent inferences as we would any conceptualization. Thus we represent sentences such as the following using AUTH:

(7) The Supreme Court decided segregation is illegal.

```

                                segregation
                                o   / \
Supreme Court <=> AUTH <---  |||  r |--> People of US
                                |||  <---|
                                ||| R   |--< S. Court
                                |||  o
                                US Courts <=> ORDER <--- punishment

```

(8) The cop gave the speeder a ticket.

```

                                driver      driver
                                /\          /\
                                o   ||      ||      r |-->driver
Policeman <=> AUTH <---  \ /      \ /      <---|
                                $TRIAL    ATRANS   |--< govt.
                                (&DEFENDANT driver)
                                (&CHARGE speeding)  ^o
                                                    money
                                                    ^r
                                                    government

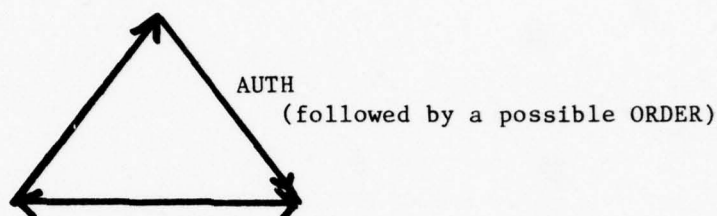
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In (7) we have chosen to ignore representing 'segregation' for the moment, since it is obviously complex. Supreme Court decisions are AUTHs. They also carry with them (as do most AUTHs) an implicit ORDER for 'punishment' if certain circumstances are met. The straightforward inference from (7) then is that someone practicing segregation can expect to be punished.

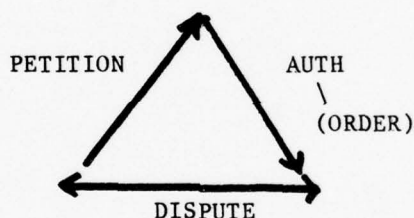
Policemen are authorities also. In (8) the ticket is a written manifestation of an AUTH that either puts the driver in a DEFENDANT role in a \$TRIAL script or forces him to pay a fine. The instrument of the AUTH is the actual ATRANS of the ticket (left out here). The important point here is that we could represent part of (8) using ATRANS only. However, what we would be describing is the physical ACT itself when it is the social ACT that is significant here. (When I (R.S.) was young there was much talk of bad kids getting "JD cards". I never understood

what was so horrible about that. Couldn't they just throw them away?) The social significance of an ACT must be represented if it is understood.

Now that we have presented these two ACTs let's return to our triangle:



We have named one side of the triangle. The other sides represent ACTs as well. The complete triangle is as follows:



The ACT PETITION represents an individual or group's act of requesting AUTH's from an authority. Thus a "civil suit" is a PETITION to the courts using some legal scripts. A protest demonstration is a PETITION to unstated authorities using some demonstration script. The point here is that we cannot do away with the scripts that describe the actual physical manifestations of these events. However, the scripts are instruments of the social ACT involved - PETITION. The most important inference from PETITION is, of course, that an AUTH is expected that will resolve the issue that is the object of the PETITION. The ACT PETITION is diagrammed below:



$$\begin{array}{ccccccc}
 & & o & & r & | & \text{---} > A \\
 X <=> \text{PETITION} <--- & & \text{SOL} <--- & & | & \\
 & & & & & | & \text{---} < X'
 \end{array}$$

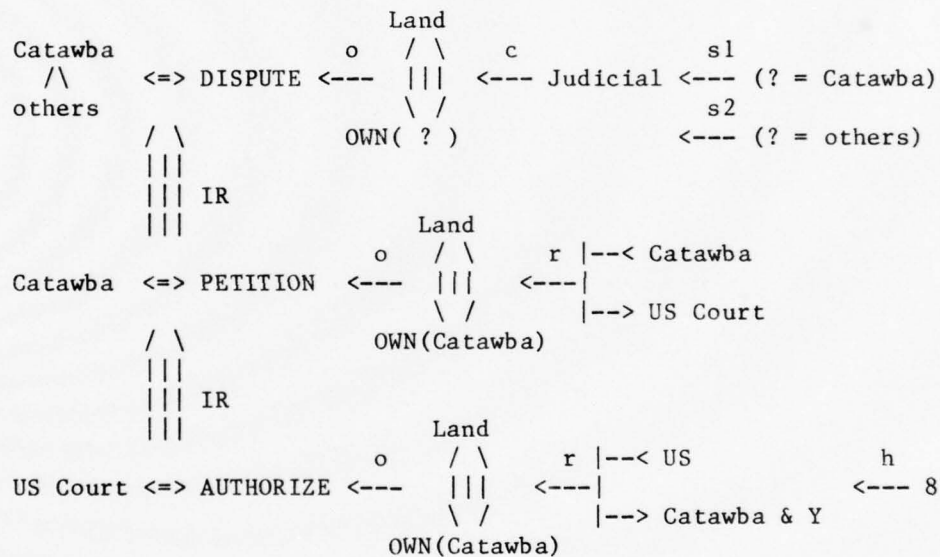
X is the instigator of the PETITION to the higher authority A. X' is the party on whose behalf X is petitioning; often X = X'. A lawyer hired by a plaintiff does a PETITION on behalf of his client when he initiates court proceedings. SOL is the change in the state of the world which X' wants A to AUTH. Hence SOL becomes the DECREE of the AUTH if A decides to AUTH as PETITIONed by X. Often SOL is the solution desired by X to a prior DISPUTE between X and another party (Y). SOL may have pointers to a set of reasons presented by X to A that support SOL as a good solution to a DISPUTE. Thus we have another social ACT, DISPUTE, whose existence often initiates one or more PETITIONS:

$$\begin{array}{ccccccc}
 & & o & & c & & s1 \\
 X \& Y <=> \text{DISPUTE} <--- & & \text{DISPUTEOBJ} <--- & & \text{DISPCAT} <--- & \text{SOLX} \\
 & & & & & & s2 \\
 & & & & & & <--- \text{SOLY}
 \end{array}$$

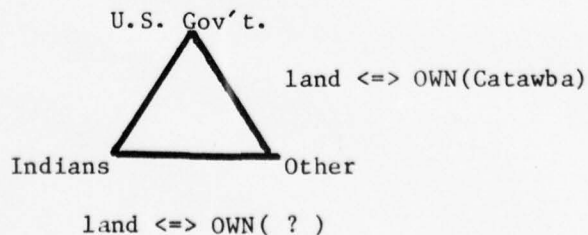
X and Y are the two co-actors of the dispute that is, the two parties at odds with each other. The DISPUTEOBJ is that which is being disputed such as ownership of an object, political control of region, or more abstract items of dispute such as the constitutionality of a law or policy (e.g. as in the Bakke case). The DISPCAT is the classification or category of the dispute, for instance military, economic, judicial, social or political. The category of the dispute seems useful in generating appropriate inferences (discussed in section 7 of this

paper). SOLX is the solution to the dispute that X wants (or will settle for): SOLY is similarly defined. DISPUTE takes no recipient as it is not an inherently directed ACT. It is the ACT of PETITION that directs it to a particular authority who can AUTH something that will resolve it.

We are now ready to deal with sentence (1) (Catawba Indians Land Claim Supported). The representation using the new social ACTs is:



Since this representation is not as easy to write as the triangular one, we shall continue to use triangles in the remainder of the paper. Thus (1) is:



We will leave out the arrows and the ACTS for diagrammatic purposes, but the above triangle should be understood as containing all the information given in the CD diagram for (1). (Actually the triangles contain more information as we shall show later.)

Consider the following three sentences:

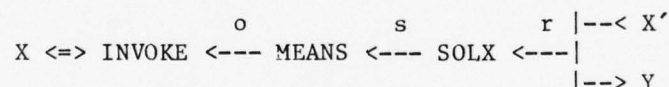
- (9) Egypt invites Israel to Cairo negotiations.
- (10) Russia invaded Czechoslovakia and replaced the premier.
- (11) Nader brought suit against GM, but the matter was settled out of court.

In each case we have a social or political dispute which is resolved without PETITIONING a higher authority to AUTH a solution to the DISPUTE. Clearly, solution methods to disputes can be categorized into external (involving a third party to AUTH solutions) and internal solution methods (where the dispute is RESOLVED directly by the disputing parties). Diplomacy is the resolution method in example (9) and Military strength in (10). In example (11) there is a PETITION to authority, but before the court can AUTH, Nader and GM RESOLVE their DISPUTE via arbitration. Hence, we have another social act, RESOLVE, diagrammed below:

o                      I

X and Y <=> RESOLVE <--- SOL <--- MEANS

The co-actors of the resolve, X and Y, are the same parties who were the co-actors of the original DISPUTE. The MEANS of resolving the problem can almost always be classified into negotiation, the application of force or the threat thereof. SOL is the solution, a description of a change in the state of the world, which ends the DISPUTE. The way to RESOLVE a dispute is to make the SOLX and SOLY cases of the DISPUTE ACT equal to each other, that is: SOLX = SOLY = SOL. Thus RESOLVE represents negotiation to converge on a mutually acceptable solution or one party imposing a solution on the other by virtue of superior strength. RESOLVE is somewhat analogous to AUTH + ORDER; we need an ACT which initiates a RESOLVE in much the same way that PETITION initiates AUTH. We call this ACT INVOKE which in turn is usually initiated by a DISPUTE. We diagram INVOKE as follows:



X initiates a course of action, on behalf of X', to RESOLVE a DISPUTE between X' and Y. Often X = X'. The MEANS case represents the course of action initiated to RESOLVE the DISPUTE; it is the same MEANS as in the RESOLVE ACT. SOLX is the solution that X intends to achieve as a result of INVOKING the MEANS. Y is the passive disputing party on whom the solution method is imposed. Consider the first conjunct of example (10) (Russia invaded Czechoslovakia). We can represent this as an INVOKE by letting X = Russian military, X' = Russia, Y = Czechoslovakia,

SOLX = Russia increasing its political control over Czechoslovakia, MEANS = Military Strength. Clearly, from this INVOKE plus what we know of the relative military strengths of Russia and Czechoslovakia, we can infer the RESOLVE with SOL = SOLX and a DISPUTE which preceded the INVOKE.

Often if X INVOKES a MEANS to resolve a DISPUTE with Y, then Y will also INVOKE the same MEANS. IF country X uses Military Strength on country Y, then Y will probably also INVOKE Military Strength to defend itself, for instance. If GM offers to negotiate with Nader, then it is likely that Nader will also INVOKE negotiate with GM (at the very least he may listen to what GM is willing to offer).

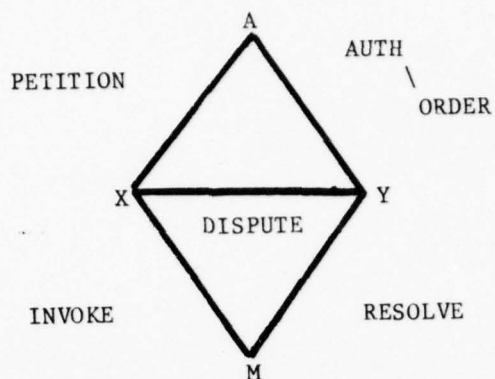
We now have two basic types of triangles:

DISPUTE -> PETITION -> AUTH + ORDER and

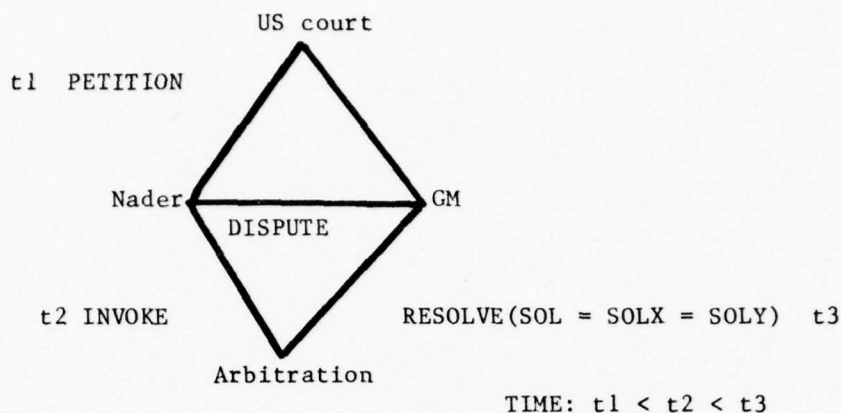
DISPUTE -> INVOKE -> RESOLVE.

The DISPUTE ACT is the same in each case, and attempts at resolving the dispute can occur in either or both triangles in any given situation. We represent the RESOLVE triangle inverted below the AUTH triangle when both solution methods are active, as in the figure below:





As was the case for the upper triangle, the lower triangle should be interpreted to mean all that is contained in the three respective social acts. Now we can represent example (11) (Nader brought suit against GM, but the matter was settled out of court).



There are some inferences that can be drawn from the above triangles: The expected AUTH following the PETITION will not happen as a result of the RESOLVE. The DISPUTE no longer exists. GM was probably the ACTOR of the INVOKE.

#### 4. Progress: Static Descriptions

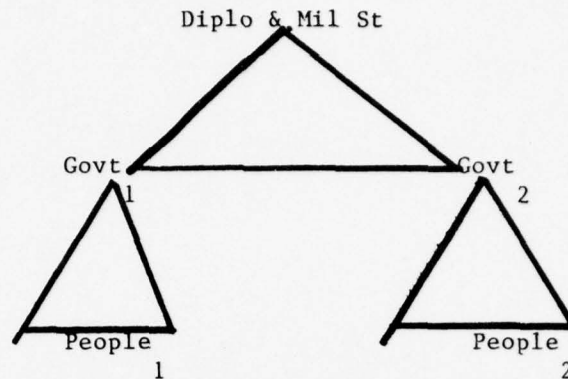
In the course of working on the problem of representing social actions, we happened across a statement by Secretary of State Vance that we found especially interesting for two reasons. First, it is real text, as are many of our previous examples. AI workers are often satisfied with processing only illustrative examples created for a specific purpose. Second the statement by Vance is an alternative description of what is basically a very similar problem to the one we encountered in the Catawba Indians sentence. That is, it lends itself well to a triangle interpretation:

(12) There will not be a Middle East treaty within a year, but there will be progress towards that goal.

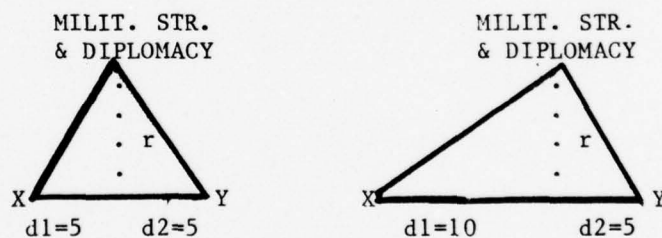


To see how triangles relate here, we need to view relationships between governments as being not essentially different from relationships between individuals. That is, governments also engage in DISPUTES. The difference is that there is frequently no obvious higher authority that will respond to PETITIONS with AUTHs. For our purposes we can recognize three kinds of authorities to mediate between governments: the UN; World Opinion; other more influential countries. The difference here is that the corresponding ACTs PETITION and AUTH cannot function in exactly the same way as they did when a government was the authority. In the case of the UN, the UN can be petitioned and it can AUTH, but its AUTH does not always have corresponding ORDER's to carry out the AUTH. World Opinion can be petitioned, but it cannot AUTH at all. The RESOLVE triangle, by its very nature, works in exactly the same way for countries and individuals. The MEANS invoked to RESOLVE DISPUTES are, in both cases, negotiation, threat or application of force. In a political context negotiation may be labeled "diplomacy". in a social context it may be labeled "arbitration", but both terms fulfill identical roles in the social ACTs. Therefore, at our level of representation, the terms are synonymous.

Our triangles are useful for representing governmental relationships in a way analogous to those used previously. The base structure is:



That is, people relate to their governments, and their governments relate to each other. In representing how governments relate, we can use the length of the base to describe the closeness of their relationship. The figure below illustrates two differing relations between countries X and Y. (For convenience we draw the RESOLVE triangle "upright" when there is no AUTH triangle to draw.)

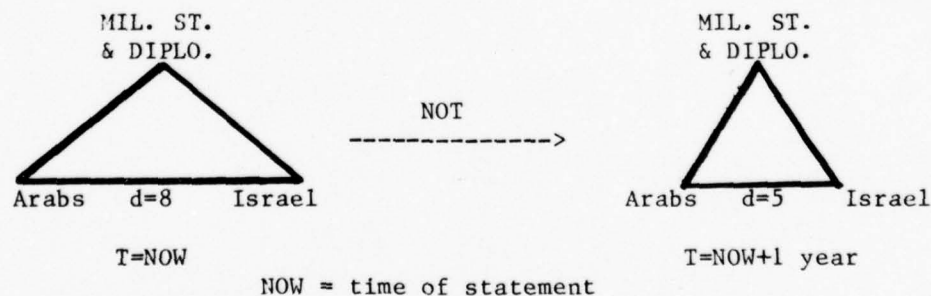


We use the perpendicular ( $r$ ) to divide the base of the triangle into two segments of lengths  $d1$  and  $d2$  respectively. We define two countries, X and Y, to be in a peaceful non-aggressive relationship if  $d1 = d2 = 5$  with respect to Military Strength and Diplomacy (figure at left above). Two countries at war would have  $d1 = d2 = 10$ . If X declares war on Y then we have a transition from  $d1 = d2 = 5$  to  $d1 = 10$  &  $d2 = 5$  (figure at right

above). Clearly,  $d_1 \neq d_2$  represents an unstable situation. If one country changes its relationship to the other country, then there probably will be a complementary change on the part of the second country. The tendency of triangles to become isosceles generalizes to interpersonal and other social relations as well. Hence, from the triangle with  $d_1 = 10$ ,  $d_2 = 5$ , we expect Y to do something causing  $d_2 = 10$ . One metaphor for countries getting more hostile towards each other is "drifting apart". We will express that by the length of the base increasing relative to our normative length (5 for each segment). Similarly, two countries with very close diplomatic or military ties to one another would be represented with  $d_1 = d_2 < 5$ . When  $d_1 = d_2$ , we write  $d$  for  $d_1$  &  $d_2$  to simplify our notation.

Any triangle has a period of time for which it is true. This fact allows us to represent sentence (12) using triangles:

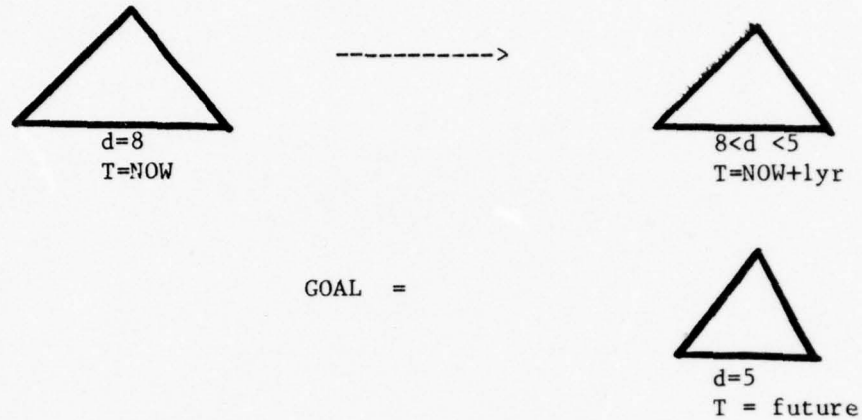
(12a) There will be no Middle East treaty within a year:



The first triangle represents the stable (i.e. war is not imminent because no side is more aggressive than the other) but hostile ( $d > \text{norm}$  (which is 5)) structure in the Middle East. The -----> represents a changing static description, --NOT--> ,

means will not change. The second triangle represents PEACE.

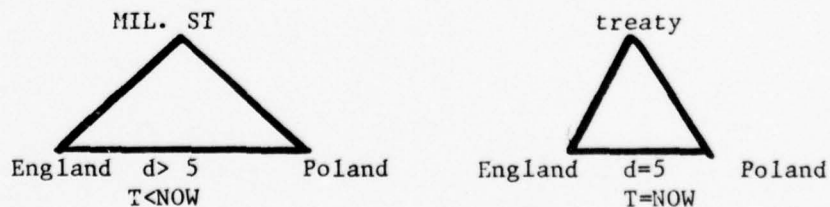
(12b) but there will be progress towards that goal.



Thus a series of collapsing triangles can be one method of representing successive state descriptions of progress towards a goal when the goal is a smaller triangle than we had at the beginning.

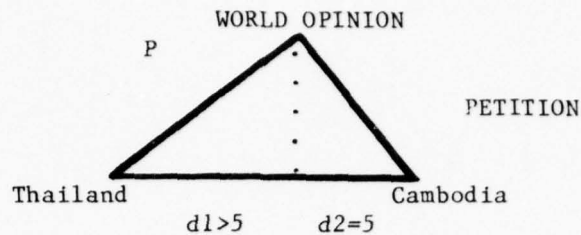
Using this representation method we can represent the socio-political essence of a number of conceptually complex sentences:

(13) England and Poland signed a peace treaty.



(14) Cambodia complained about Thailand's violation of their air space.





In (14) we have both of the facets of triangles available to us. The increased left segment of the base indicates an unstable situation caused by Thailand. In response, Cambodia has appealed to World Opinion. We expect that such a situation will tend to stabilize, either by Cambodia turning towards MILITARY STRENGTH as an arbiter (making the triangle isosceles with a larger base) or by Thailand backing down (reducing the triangle to its basic isosceles form (base  $d = 5$ )).

The ACTs that World Opinion and the UN can perform seem weak at best. The AUTH that is performed by an authority implies that the proposition AUTH-ed is now officially true and that an ORDER will follow if necessary to make the thing AUTH-ed happen. No such inferences could reasonably be said to follow from what World Opinion or most UN AUTHs.

A primary purpose of developing the social acts is to formulate a mechanism for making the inferences made by people reading about socio-political interactions. In this light, it seems important to be able to identify inferences as such. One way to recognize and analyze inferences is the 'but' test. (The 'but' test, Schank (1975) is used to establish what is an

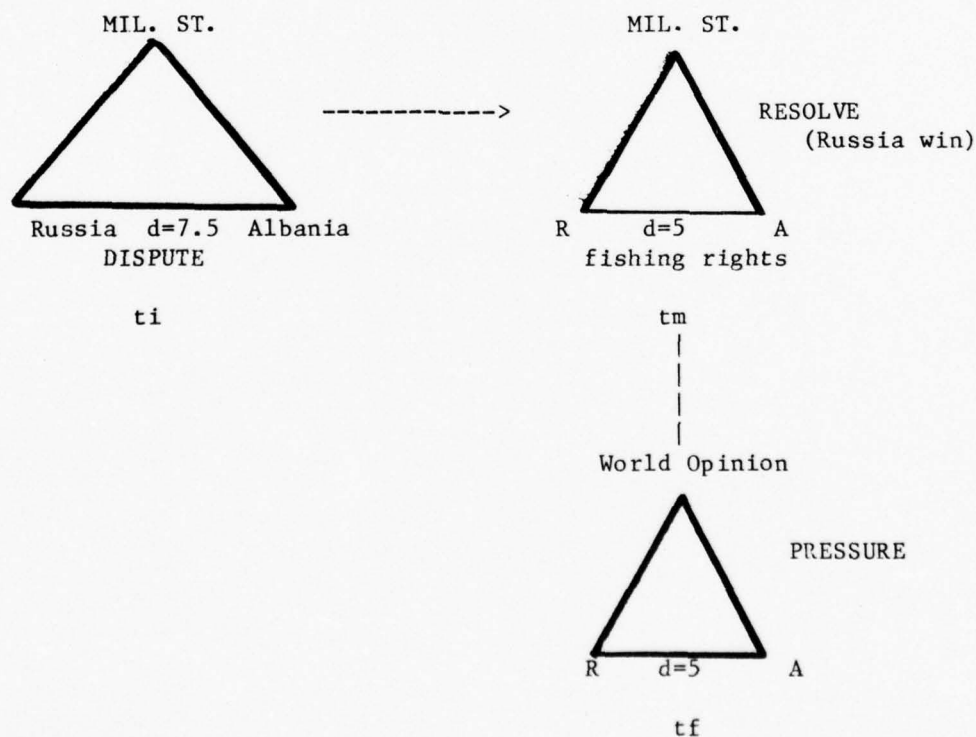
inference from an ACT. If a phrase follows a 'but' naturally after an initial proposition its negation is a reasonable inference.) For RESOLVE consider the following sentence:

(15) Russia launched an attack on Albania because of a dispute concerning fishing rights in the Adriatic, but Albania won.

The 'but' wouldn't make sense here if we didn't naturally assume that Russia had the stronger military. (Contrast (15) with the same sentence using the ending 'but Russia won'). Since (15) is a bit unnatural as a sentence due to its curtness consider (16) as another example of the same effect:

(16) Russia attacked Albania because of a dispute over fishing rights in the Adriatic, but Albania retained its rights when world opinion forced the Russian to back down.

What we have here is:



The diagram shows the initial state (ti), the medial state (tm)

(the normal inference from the condition in ti; this is what the 'but' negates), and the final state (tf) that is caused by the action of World Opinion. We call that ACT PRESSURE. Its normal inferences are simply that the PRESSUREd party stops doing what it was doing that created a non-isosceles triangle. The triangle thus returns to normal.

PRESSURE is the most neutral of the three right side of the triangle ACTs in that it does not imply direct actions of any sort. Why countries succumb to pressure is undoubtedly complex. That they do needs to be represented. The social ACT PRESSURE is diagrammed as follows:

$$\begin{array}{ccccccc} & & o & & c & & r \\ Z <=> & PRESSURE <--- & SOL <--- & PCAT <--- & | & --> X \\ & & & & & & | \\ & & & & & & | & --< Y \end{array}$$

The conceptual cases of this social ACT should be interpreted in the following manner: Z applies PRESSURE to X on behalf of (or at the request of) Y in order to make X DO (or stop DOing) something to achieve SOL. PCAT is the type of PRESSURE applied by Z; economic, political, peer group are some of the more common types of PRESSURE in the socio-political domain.

PRESSURE has its analog in relationships between Governments and their people as we shall see in the next section.

##### 5. Relationships between Authorities and their Constituents

One advantage of the triangle representation system is its use in explaining in a simple way such complicated concepts such as 'power', 'democracy', 'liberty', etc. The ACT AUTH is the essence of the meaning of power for example. 'Power' means the ability to be the actor in an AUTH. The more AUTHs one can do over a wide range of subjects the more power one has. A president of a company can AUTH in matters concerning his company. That is where his power is. A mother can AUTH over her children by virtue of her social role in the family. Children usually accept parental AUTHs without questioning their legitimacy; this essentially gives the parent the power to AUTH. As long as a parent has some psychological, emotional, or physical control over them she can ORDER to enforce her AUTHs.

'Democracy' is clearly a very complex concept. A simple approximation of its meaning can be obtained using the triangle format. If a government is a system that AUTHs in response to petitions, then the correlation of PETITIONS to AUTHs would represent one measure of the workings of the government. For example, a dictatorship is a government where the AUTHs are motivated by the goals of the head of state rather than by petitions of the people. Ideally a democracy is a government where all AUTHs are motivated by PETITIONS backed by a majority of the people. A 'responsive government' is one where all PETITIONS result in AUTH of one kind or another. A 'benevolent despot' is one who issues AUTHs without regard for PETITIONS, but in accord with what he believes the PETITIONS might be (or would be if the people knew how to best govern themselves).



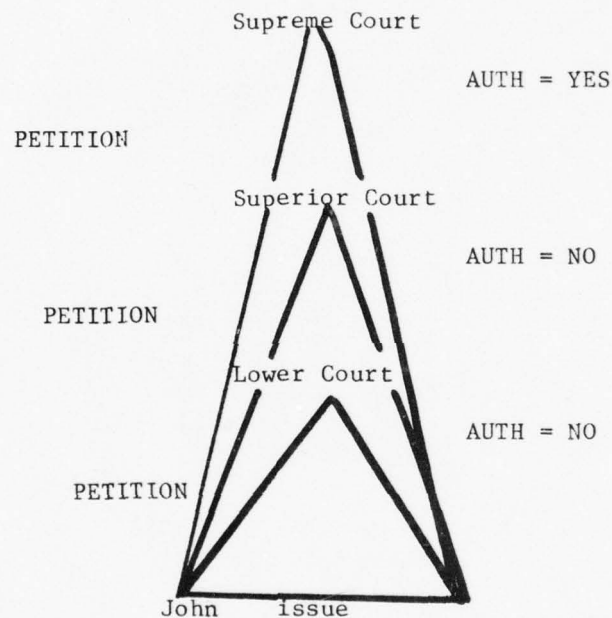
Such simplistic definitions are of course just that. However, regardless of the inaccuracy of these definitions from a political scientist's point of view, it must be remembered that we are attempting to understand language. Furthermore we are attempting to model the average person's understanding of a political situation since that is what is being referred to by the everyday language that is used to report on these situations. What we have here should in no way be assumed to be addressing the issue of what is 'really' going on in political situations. We are not trying to simulate the understanding of the expert. Thus, a definition of equality in a country as "a government where every person gets to PETITION and where the PETITION has the same chance of resulting in an AUTH as any other persons PETITION" might be a more accurate way of describing what was meant by Lincoln when he said that all men are created equal than one dealt with physical or mental equality.

The relationship between people and their governments is one much touched upon in text. Thus any system of social-political representation can be evaluated by its ability to deal with such texts.

One of the first things to recognize is that rather than one triangle to represent this relationship what is needed is a hierarchy of triangles. That is, there are many avenues of appeal in a governmental system or in any power system. The notion of a "higher authority" must be represented.

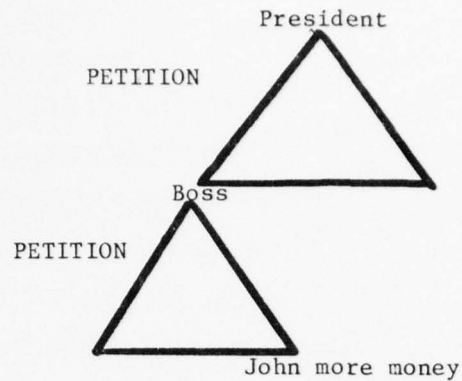
To do this, we take advantage of another aspect of triangles, namely their height. The taller the triangle, the more power (and more distance from the people) the authority at the top is said to have. Thus successive appeals might look like this:

(17) John appealed the negative decision of the lower courts to the superior courts, which upheld the lower courts ruling and finally to the Supreme Court who overturned it.



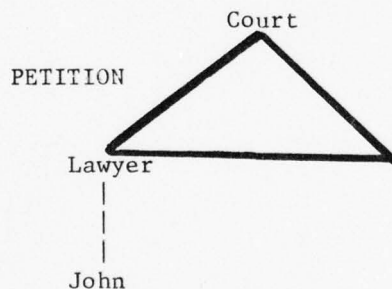
This hierarchy looks a little different in the case where the authority in the first part becomes the petitioner's advocate in the second:

(18) John asked his boss for a raise. His boss took it up with the president of the company.

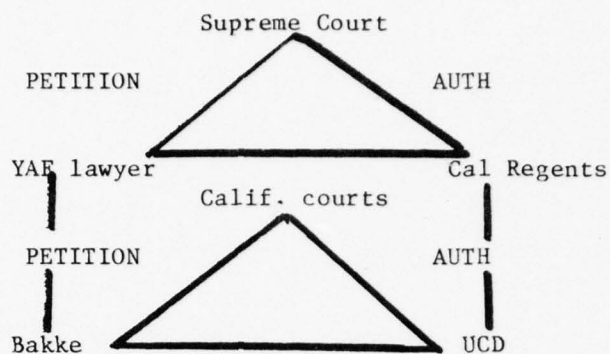


This agency relationship looks as we have shown above in the case where the agent (Boss here) is also an authority over the petitioner. In the case where the petitioner uses an advocate who is not an authority (a lawyer for example), we represent the situation as follows:

(19) John had his lawyer ask the court for a ruling.

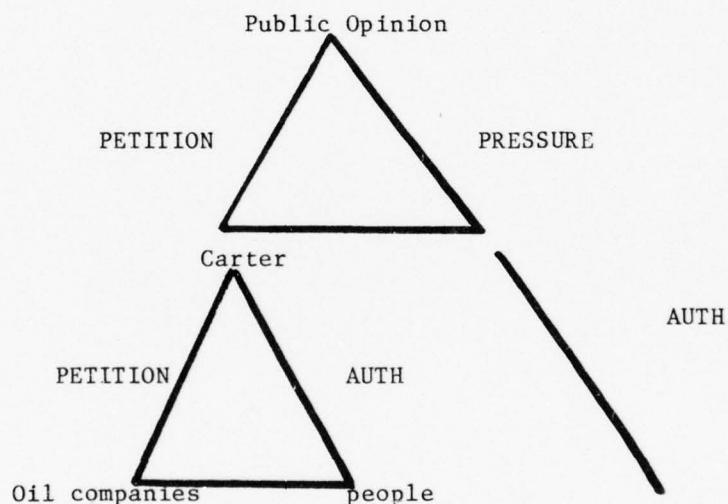


We will call his relationship AGENT. This is a basic stative relationship that is used frequently. For example, in the Bakke case, Bakke was represented by lawyers hired by the YAF, U C Davis was represented by the California Regents, in the case before the Supreme Court. This is shown below:



Higher authorities can be invoked by analogy to how governments relate to each other. Thus we can get a sentence like (17):

(20) Carter changed his energy policy as a result of public outrage.



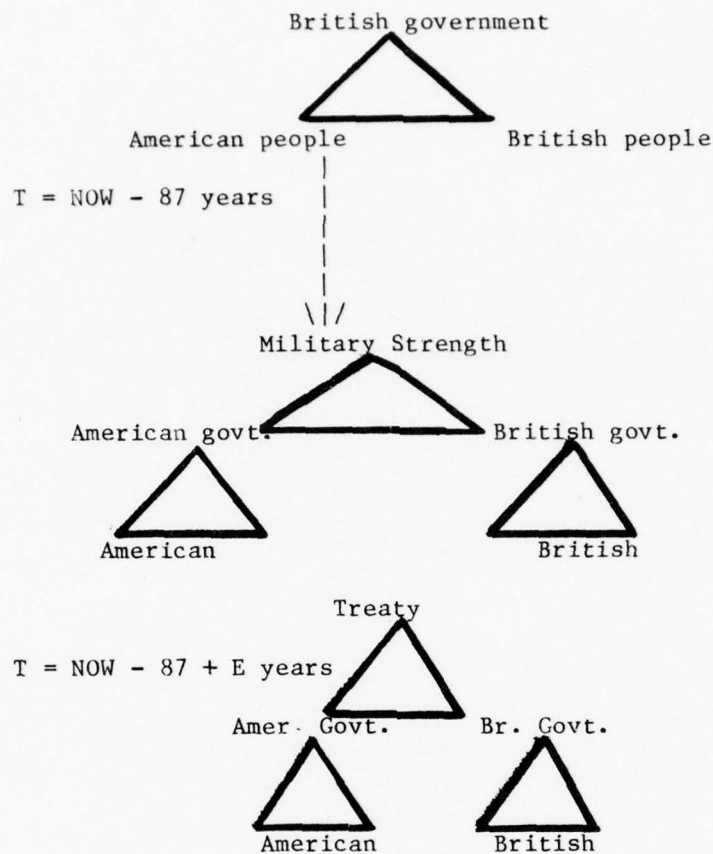
## 6. The Gettysburg Address

We are now ready to discuss the representation of the beginning of the Gettysburg Address.

(21) Four score and seven years ago our forefathers brought forth upon this continent, a new nation



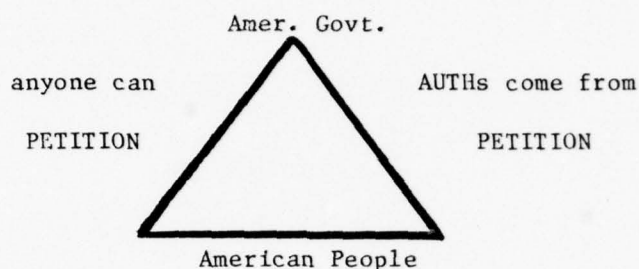
T = NOW - more than 87 years



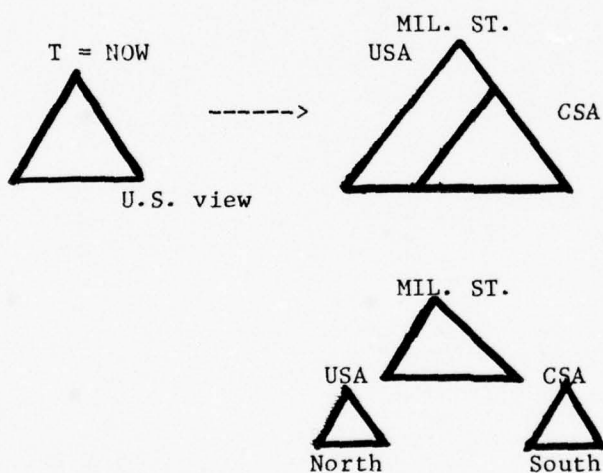
(21) describes three states of triangles. The initial triangle represents the two peoples being governed by the British. The second diagram shows that the initial triangle has split into two triangles (two governments). These governments are known to have been at war. This was not stated in (21), but since it was true we have chosen to represent it. The creation of a new nation then, is shown by one triangle becoming two.

(22) conceived in liberty and dedicated to the proposition that all men are created equal.

(22) must be represented as the manner in which the authorities in the new government treat the people. Thus we have two propositions that are true of the new triangle:



(23) Now we are engaged in a great Civil War



A Civil War is a split in a triangle as before. We have chosen here to represent the two different views of a Civil War (we could have done so with the Revolutionary War too, of course). The USA view has the triangle split with a war attempting to resolve the split. The CSA view has the split having taken effect. There are thus two different countries at war in this

view. The important point here being, that when the war stops in the USA view the split ceases and the triangle is whole. In the CSA view if the war would stop the two triangles could exist as two separate countries.

What we are doing here is not representing the Gettysburg Address so much as we are representing the political history surrounding the events being discussed in the Gettysburg Address. We have thus left out the birth metaphor we discussed earlier and have chosen to focus on understanding the content underlying the metaphor. The value of the metaphor? Well, we leave that to literary critics to analyze.

#### 7. The Use of Triangles

Triangles provide us with a method for representing the social significance of actions. As with any other representations scheme, the advantage of the symbols we create can only be in the new symbols or actions that they spawn. That is it is the inferences that come from the triangles that are of key importance. When we created the original primitive ACTs we said that PROPEL was no more than the set of inferences that it fired off. The same is true here, so we must ask what these inferences are.

The first thing we can recognize about potential inferences here is that they will come in two varieties. The first are the inferences that are fired off from the new social ACTs that we have created. The second kind are those that come from the

triangles themselves. That is, there should be patterns of triangles that are recognizable for the triangles they spawn as well as a set of inferences that come from the fact that certain triangles exist.

#### AUTHORIZE

We shall first analyze the inferences that are applicable to each social ACT. For each ACT there are inferences which state something which must have or may have occurred before the ACT took place, and inferences which describe relevant changes in the state of the world as a result of the ACT. The latter category includes inferences which create expectations about future ACTs which are likely to occur. We respectively label our inference rules antecedent and consequent, not to be confused with the PLANNER deduction rules similarly labeled. We give a precise formulation of the inference rules triggered from each social ACT after considering some illustrative examples.

Consider the plausible inferences that can be made from a typical AUTH such as Example (1) (Catawba Indian land claims supported). We know that the authority supporting the land claims is probably a U.S. court of law. We are also quite certain that the Indians must have filed the land claim (a PETITION) and that the ownership of the land is probably contested by another party (a DISPUTE, otherwise there would have been no need to file the claim). If the other party claiming ownership of the land refuses to give it to the Indians, we are

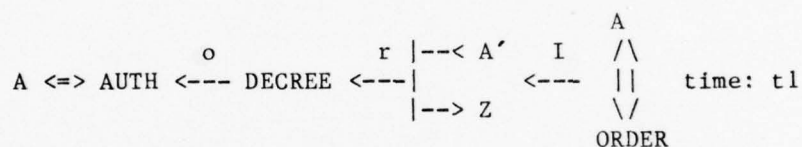


fairly sure that the U.S. will do something to enforce its ruling (issue an ORDER). We would not be surprised to hear that the Indians and the other party may have tried to resolve the issue before (or during) the judicial proceedings (INVOKE either negotiations or strength via occupation of the land). Indeed, some of us may suspect, from previous knowledge of Indian land disputes, that there was some sort of open confrontation. Are there other types of inferences that we can make from example (1)? We have not yet considered the predictive inferences which may answer questions such as: What might the other party do at this point? How about the Indians? Will the court decision stand? Will it be obeyed? The Catawba Indians are probably satisfied with the court decision - how do we know that? We cannot say to have really understood example (1) unless we can answer most of these questions.

The goal that the Indians were striving for was ownership of the disputed land; we infer this from the fact that ownership of land was the object of their PETITION. Since the U.S. court ruled in their favor (i.e. AUTHed that which the Indians PETITIONed), we know that the Indians achieved their goal. Hence we conclude that the Indians are satisfied and predict no further acts on their part. The opposite is the case for the other party involved in the land dispute. Their goal, also ownership of the land has been violated by the decision of the court. We expect that they might appeal the verdict (PETITION to a higher authority) or (less likely) try to hold on to the land by force (INVOKE strength) or possibly both. If there is no

higher court to appeal to we expect that the decision will stand and that the court may (through another branch of the government) enforce its ruling (ORDER).

The inference rules we illustrated in this example can be stated more precisely. We need the more exact formulation of our inference rules in order to build a computer system that can systematically apply them to understand stories such as the twenty-two examples considered in this paper. In our analysis of example (1) we applied most of the inference rules listed below for AUTH and two of the rules indexed under PETITION.



Antecedent inference rules:

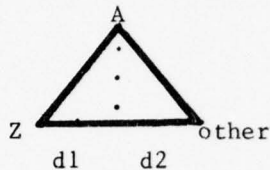
- (1)  $Z <=> \text{PETITION} <-r- A \text{ time: } t_2 < t_1$
- (2) If DECREE = goal of Z then the  $<-o-$  case of the PETITION probably = DECREE.
- (3)  $Z \& \text{ other } <=> \text{DISPUTE} \text{ time: } t_3 < t_2$
- (4) If  $Z \& \text{ other } <=> \text{INVOKE} <-o- \text{MEANS}$  then the MEANS failed in RESOLVING the DISPUTE. time  $t_4 < t_1$

Consequent inference rules: (time  $> t_1$ )

- (5) If Z does not accept the DECREE then expect  $A <=> \text{ORDER}$ .
- (6) If  $h > 8$  or there is no authority higher than A to PETITION to (and  $h > 5$  = normative value), then expect Z and the other party to accept the DECREE and end their DISPUTE.

Otherwise consider rules 7 and 8.

(7) If DECREE = GOAL(Z) then expect the other party to PETITION an authority higher than A with the <-s- case = GOAL(other). Also expect other <=> INVOKE <-o- MEANS to RESOLVE the DISPUTE directly. d1 may decrease and d2 may increase in the triangle:



this may balance a previously unstable situation, or it may unbalance an isosceles triangle. We need to reference the triangle itself in order to make other consequent or predictive inferences from the possible changes in d1 and d2.

(8) If DECREE = GOAL(other) then the converse of rule 7 applies.

(9) If DECREE = compromise then possibly DISPUTE between Z and other will terminate. (It may prove difficult to recognize when a DECREE constitutes a compromise between two proposed solutions in our eventual computer implementation of these inference rules.)

#### ORDER

ORDER is an instrumental act to AUTH. As such it is significant mostly because of the AUTH that can be inferred from it. Sometimes an ORDER appears explicitly in text; in other instances the ORDER itself must be inferred, as in the following

example:

(24) The federal government suspended aid to the Chicago schools on grounds of continued segregation.

In example (24) we have a case where punishment is applied because an ORDER was not obeyed. We can infer that the government ORDERed the desegregation of the schools, with the (possibly implicit) punishment of cutting federal aid. Further inferences are triggered from the ORDER: The government must have AUTHed that segregation was illegal. If the government chose cutting aid as punishment, then it is probably the case that it is a worse consequence for the Chicago schools than the ORDERed desegregation. The Chicago schools will probably desegregate in the near future. The government AUTH that segregation is illegal will probably result in an end to (institutionalized) segregation. We can also generate a large number of inferences from the AUTH, but we believe that these second order inferences are usually not generated when a sentence like example (24) is understood.

The precise statement of the inferences triggered from ORDER are listed below:

$$\begin{array}{ccccccc}
 & & o & & r & | & \neg \neg < A' & & a \\
 A <=> \text{ORDER} <--- & \text{ACT} <--- & | & & & <--- & \text{ALT} & \text{time: t1} \\
 & & & & & | & \neg \neg > Z & & 
 \end{array}$$

Antecedent inference rules:

(1) It must have been the case that:

$A' <=> \text{AUTH} <-o- \text{DECREE} <-r- Z$  where  $Z <=> \text{ACT}$  or its result



is the DECREE (time  $t_2 < t_1$ ).

(2) If  $A \text{ not} = \text{to } A'$  then

$A' \Leftrightarrow \text{AUTH} \text{ } \leftarrow \text{o-} (A \Leftrightarrow \text{ORDER}) \leftarrow \text{r-} A \text{ (time } t_3 < t_1 \text{)}.$

Consequent inference rules:

(3) Z will probably do ACT.

(4) If Z does ACT then the DECREE of the preceding AUTH will be established as a change in the state of the world.

(5) In the case that Z does not do ACT, A will do ALT to Z (e.g. Jail or fine Z if  $A'$  is court of law.)

#### PETITION

PETITION triggers a rather rich set of inferences. Some of these inferences are shared with INVOKE, but others can only be made from PETITION. Let us reconsider the first clause of example (11) (Nader brought suit against GM, but the matter was settled out of court). This is clearly a PETITION to a court of law. We can conclude that there must have been a DISPUTE of a judicial nature between Nader and GM. From the first clause we infer that the US court will AUTH a solution to the DISPUTE. This inference is violated by the 'but' construction in the second clause of (11). (Recall the 'but test' tells us that the second clause must be violating an inference triggered from the first clause.) Other inferences triggered from "Nader brought suit against GM" include: GM might bring a counter suit against Nader. GM might apply PRESSURE on Nader to drop his suit. GM might PRESSURE the US government to AUTH the court to drop the



suit (e.g. lobby for legislation whose effect is to nullify the legal grounds on which Nader's law suit is based). Nader or (more likely) GM might INVOKE negotiation to RESOLVE their DISPUTE without waiting for the court proceedings to conclude. The second clause of example (11) states that this last inference is what indeed happened. In order to establish a causal connection between the two clauses in our example, it was essential to realize that the highly expected AUTH inference was violated and that the INVOKE negotiation inference was confirmed. The inferences just discussed are stated in more precise terms in the list below:

$$\begin{array}{rcl}
 & o & r \mid \rightarrow A \\
 X \Leftrightarrow \text{PETITION} & \leftarrow \text{---} & \text{SOL} \leftarrow \text{---} \mid \text{time: } t1 \\
 & & \mid \rightarrow \text{---} X'
 \end{array}$$

#### Antecedent inference rules:

(1) There was probably a DISPUTE between  $X'$  and some other party (Y), with  $\text{SOLX (of the DISPUTE)} = \text{SOL (of the PETITION)}$ . ( $t2 < t1$ ) The words "probably" and "possibly" are used to convey an intuitive degree of certainty of the inference rule yielding true statements.

(2) There may have been an  $X \Leftrightarrow \text{INVOKE} \leftarrow r - Y$  which did not result in a RESOLVE.

#### Consequent inference rules:

(3) A will probably AUTH a solution to  $X'$  (and any party involved in a DISPUTE with  $X'$ ). ( $t3 > t1$ )

(4) If  $X \Leftrightarrow \text{PETITION} \leftarrow o - \text{SOL} \leftarrow r - B$  (where B is a lower

authority than A) at time  $t_4 < t_1$  then it was the case that  $B \Leftrightarrow$   
 AUTH  $\leftarrow$ o- DECREE (where DECREE is NOT equal to SOL.) time  $t_5$ ,  
 where  $t_4 < t_5 < t_1$ .

(5) Expect Y (where Y is the party in DISPUTE with X) to also  
 PETITION A with SOL = SOLY (of the DISPUTE).

(6) It is possible that  $Y \Leftrightarrow$  INVOKE  $\leftarrow$ o- <Strength> to force  
 X to accept SOLY before A can AUTH. Time  $t_6 > t_1$

(7) It is possible that  $Y \Leftrightarrow$  INVOKE  $\leftarrow$ o- <negotitaion>  $\leftarrow$ r-  
 X to RESOLVE the dispute by creating a SOL = SOLX = SOLY (this  
 entails a willingness on the part of X and Y to compromise on  
 their original desired SOL(X or Y)) before A can AUTH a SOL not =  
 SOLY. Time  $t_7 > t_1$

#### DISPUTE

What can we infer from a from the statement of a DISPUTE?  
 Let us analyze the following example:

(25) Ethiopia and Somalia are in conflict over the Ogden Desert.

We represent example 25 as follows:

Ethiopia		o		c
and	$\Leftrightarrow$	DISPUTE	$\leftarrow$ ---	SCONT(Ogden) $\leftarrow$ ---
Somalia				Political
			s1	
			$\leftarrow$ ---	Ogden <s> SCONT(Ethiopia)
			s2	
			$\leftarrow$ ---	Ogden <s> SCONT(Somalia)

From the above DISPUTE we may infer the following: Either  
 country may PETITION the UN or World Opinion to AUTH a  
 settlement. Either country may INVOKE negotiation or military  
 strength; in the latter case the DISPUTE would escalate to a

Military category. A third country may be PETITIONed to PRESSURE one of the DISPUTING countries to either abandon the DISPUTE or partake in negotiations INVOKED by the PETITIONing country. The set of inferences presented below for DISPUTE have a somewhat different flavor than those triggered from AUTH or PETITION.

```

              o               c               s1
X & Y <=> DISPUTE <--- DISPUTE OBJ <--- DISPCAT <--- SOLX
                                   s2
                                   <--- SOLY

```

#### Antecedent inference rules:

There are no highly probable inference rules for inferring social ACTs that may have preceded a DISPUTE. We can infer that X has the GOAL of bringing SOLX about, similarly for Y, but this is hardly more than restating the definition of SOLX and SOLY. The cause of the DISPUTE may be inferred in terms of goal conflicts between the actors (for instance see Carbonell 1978) or violated inference rules triggered from other social ACTs. For example, the original DISPUTE in the Bakke case (analyzed in an earlier section) is largely caused by Bakke <=> PETITION <-o- admittance <-r- USC which did NOT RESULT in the desired AUTH by USC. Hence, there was both a goal conflict between Bakke and the USC affirmative action policy, as well as a violated expectation (or hope) on Bakke's part that his PETITION would be favorably AUTHed. It seems feasible to develop a more complete mechanism (e.g. a set of rules) to attribute causes to DISPUTES, but this might require a more general formalism than the social ACTs (for instance GOALS and PLANS in Schank and Abelson 1977).

Consequent inference rules:

(1) X or Y may PETITION some authority (A) to AUTH a SOLUTION to the DISPOBJ. The PETITION SOL case will = the SOL(X or Y, depending on who PETITIONs) case of the DISPUTE. Who X and Y are in conjunction with the DISPCAT determines what authority X or Y may appeal to. (e.g. if X and Y are countries and their DISPUTE is Economic then A may = World Bank; if their dispute is Political, then A may = the UN General Assembly.)

(2) X or Y may INVOKE a MEANS to RESOLVE their DISPUTE directly (without involving an authority). If DISPCAT = Military then MEANS probably = Military Strength. If DISPCAT = Social, Judicial or Economic then MEANS probably = Negotiation. If X is stronger than Y, then X is more likely to use MEANS = (Military or Physical) Strength than if Y is the stronger party.

(3) If the DISPUTE is not resolved after a PETITION and/or INVOKE, then it is likely that the DISPUTE will broaden to other DISPCAT in the following manner: Political DISPUTES which remain unresolved may become Military DISPUTES. Economic DISPUTES between individuals may trigger Judicial DISPUTES. Economic DISPUTES between nations may become Political in nature. Ideological DISPUTES tend to escalate to all other categories of DISPUTE.

INVOKE

Recall example (10) (Russia invaded Czechoslovakia and replaced the premier.) The first clause of this example is an INVOKE of Military Strength. We can infer that there probably

was a DISPUTE between Russia and Czechoslovakia, and that this DISPUTE will probably be RESOLVED by the use of Military Strength. Since we know that Russia is the stronger nation, we infer that Russia will win the confrontation and therefore dictate the terms of the RESOLVE. If we did not know the relative strengths of the two nations we may still guess that Russia was the stronger, because only thus could Russia hope to achieve its goals through INVOKING Military Strength. We may also infer that Czechoslovakia may PETITION the UN, World Opinion, or other nations to PRESSURE Russia to stop its military actions. In order to establish the causal connection between the two clauses of example (10) we need to make the inference that Russia will achieve social control of Czechoslovakia (this is a result of RESOLVE by military means) and we need the rule that social control gives Russia the power to AUTH in Czechoslovakia. Russia was thus able to AUTH the change in government of Czechoslovakia. Here are the inference rules triggered from INVOKE:

$$\begin{array}{ccccccc}
 & & o & & s & & r \\
 X \Leftrightarrow \text{INVOKE} & \text{<---} & \text{MEANS} & \text{<---} & \text{SOLX} & \text{<---} & \begin{array}{l} | \text{--< } X' \\ | \text{--> } Y \end{array}
 \end{array}$$

Antecedent inference rules:

(1)  $X'$  and  $Y$  were probably involved in a DISPUTE whose DISPCAT is commensurate with the MEANS INVOKED to RESOLVE the DISPUTE.

(2) SOLX of the INVOKE = SOLX of the DISPUTE.



(3) If MEANS = (Military or Physical) Strength then probably X is stronger than Y.

(4) Possibly X  $\Leftrightarrow$  PETITION  $\leftarrow$ -o- SOLX  $\leftarrow$ -r- A Without getting the desired A  $\Leftrightarrow$  AUTH  $\leftarrow$ -o- SOLX.

(5) Possibly Y  $\Leftrightarrow$  PETITION  $\leftarrow$ -o- SOLY  $\leftarrow$ -r- A And X wants to RESOLVE the DISPUTE with Y before A  $\Leftrightarrow$  AUTH  $\leftarrow$ -o- SOLY. This rule is not far-fetched as it may seem at first glance it is necessary, for instance, in understanding a version of example (11): Nader brought suit against GM, but GM offered to settle out of court. Rule 4 connects the two sentences by establishing the most probable reason WHY GM offered to settle their DISPUTE.

Consequent inference rules:

(6) Expect Y  $\Leftrightarrow$  INVOKE  $\leftarrow$ -o- MEANS  $\leftarrow$ -s- SOLY, where MEANS is the same as in the original INVOKE.

(7) Expect X & Y  $\Leftrightarrow$  RESOLVE  $\leftarrow$ -o- SOL  $\leftarrow$ -I- MEANS.

(8) If X & Y do NOT RESOLVE then expect X  $\Leftrightarrow$  PETITION or X  $\Leftrightarrow$  INVOKE  $\leftarrow$ -o- other MEANS.

(9) If MEANS = Strength and Y is weaker than X, then expect Y to PETITION a third party to PRESSURE X into not forcing a RESOLVE.

#### RESOLVE

Let us again look at example (11) (Nader brought suit against GM, but the matter was settled out of court). The second clause is a RESOLVE by means of negotiation. We can immediately infer, just from the second clause, that there was a DISPUTE

between Nader and GM, that the DISPUTE no longer exists, and that either Nader or GM INVOKEd negotiation to come to the settlement. Since the matter was RESOLVED by negotiation (i.e. mutual agreement) then their settlement will probably not be challenged by either party. If there were any pending PETITIONs about the original DISPUTE, then their corresponding AUTHs will not take place. We can also make several less certain inferences such as: GM may have PRESSUREd Nader to negotiate or vice versa. The Government may AUTH that each side live up to its side of the agreement. More precisely, the list of inference rules for RESOLVE is:

$$X \text{ and } Y \iff \overset{o}{\text{RESOLVE}} \iff \overset{I}{\text{SOL}} \iff \text{MEANS} \quad \text{time: } t_1$$

Antecedent inference rules:

(1) It must have been the case that either:

$X \iff \text{INVOKE} \iff \text{--o--} \text{ MEANS} \iff \text{--s--} \text{ SOLX (time: } t_2 < t_1) \text{ or}$

$Y \iff \text{INVOKE} \iff \text{--o--} \text{ MEANS} \iff \text{--s--} \text{ SOLY (time: } t_2 < t_1).$

(2)  $X \text{ and } Y \iff \text{DISPUTE} \iff \text{--s1--} \text{ SOLX} \iff \text{--s2--} \text{ SOLY} \iff \text{--c--} \text{ DISPCAT}$   
(time:  $t_3 < t_2 < t_1$ ). The SOLX and SOLY cases are the same as in the INVOKE. The MEANS is appropriate to the DISPCAT of the DISPUTE.

(3) If MEANS = (Military or physical) Strength

then if X is stronger than Y, SOL = SOLX

else SOL = SOLY.

(4) If MEANS = Negotiation then SOL is likely to be a compromise between SOLX and SOLY (hence acceptable to both X and

Y).

Consequent inference rules:

(5) SOLX is now part of the state of the world. In a RESOLVE there is no appeal to a higher RESOLVE as there is PETITION to a higher authority in many cases where X or Y is dissatisfied with the SOL of the AUTH.

(6) The DISPUTE between X and Y has been eliminated.

(7) If MEANS = application of Strength then the weaker party (say Y) may either PETITION an authority to AUTH an undoing of the RESOLVE, or PETITION a third party to PRESSURE X to undo the RESOLVE with Y.

#### PRESSURE

Social or political pressure can manifest itself in many forms, but there are some general inference rules triggered from social ACT PRESSURE that are independent of its physical manifestation. Let us list some inferences triggered from the following instance of PRESSURE:

(26) The business community, fearing renewed inflation, forced Carter to reconsider his 1976 tax rebate bill.

There was an economic DISPUTE between the business community and some other economic group in the US (e.g. big labor). Carter had AUTHed a tax rebate. Carter may decide to yield to the business PRESSURE by reversing his AUTH. Carter may PETITION public opinion to PRESSURE the business community. We list below the inferences grouped under PRESSURE:

$$\begin{array}{ccccccc}
 & & o & & c & & r \\
 Z \Leftrightarrow \text{PRESSURE} & \text{----} & \text{SOL} & \text{----} & \text{PCAT} & \text{----} & | \text{--} \rightarrow X \\
 & & & & & & | \text{--} < Y
 \end{array}$$

time: t1

Antecedent inference rules:

(1)  $X \& Y \Leftrightarrow \text{DISPUTE} \text{ <-c- DISPCAT at time: } t2 < t1$ , with  
 SOL = SOLY.

(2) Either  $X \Leftrightarrow \text{INVOKE} \text{ <-o- Strength <-s- SOLX}$   
 or  $X \Leftrightarrow \text{PETITION} \text{ <-o- SOLX <-r- A at time: } t3; t2 < t3 < t1$ .

(3) Probably  $Y \Leftrightarrow \text{PETITION} \text{ <-o- (Z <=> PRESSURE) <-r- Z}$   
 at time:  $t4; t2 < t3 < t4 < t1$ .

(4) If X is an authority with respect to Y, then possibly  $Y \Leftrightarrow \text{PETITION} \text{ <-o- SOL <-r- X}$ , but X did not AUTH <-o- SOL.

Consequent inference rules:

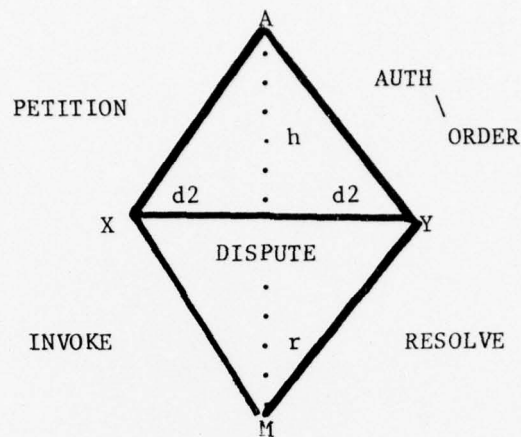
(5) X is now more likely to INVOKE <-o- Negotiation to end  
 his DISPUTE with Y.

(6) Possibly  $Z \& X \Leftrightarrow \text{DISPUTE}$  may arise.

(7) Possibly  $X \Leftrightarrow \text{PETITION} \text{ <-r- W to PRESSURE Y or to PRESSURE Z}$ .

There are, of course, many more inferences than the ones listed above for each social ACT: we listed the ones which yield information relevant in applying the social ACTs to understand socio-political events. There is a set of inferences which is triggered from the triangle structure itself. We diagram the complete AUTH and RESOLVE triangles with all relevant parameters below:

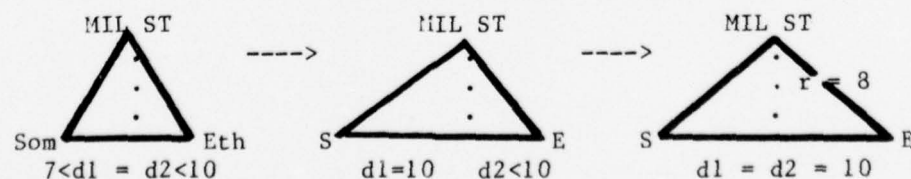




Recall that  $h$  is a measure of the degree of authority that  $A$  can exercise over  $X$  and  $Y$ ;  $r$  is a measure of the effectiveness of  $M$  (the MEANS INVOKED to RESOLVE the DISPUTE) with respect to  $X$  and  $Y$ . In the inference rules listed below 'DO' represents any applicable social ACT. In accordance with our previous definitions,  $X$  can DO something to change  $d1$  and only  $d1$ , similarly for  $Y$  and  $d2$ .

Let us consider an the escalation of the Somali-Ethiopian conflict.

(27) Somalia declared War on Ethiopia after the Ogden conflict. We can represent this situation by the following sequence of triangles (although only the center triangle is explicitly stated in (27)):



The first and third triangle can be inferred from the central



one; this is to say that from (27) we infer: Ethiopia and Somalia were NOT at war earlier, (although they were involved in a political dispute). Ethiopia will probably also declare war on Somalia. The war will probably resolve the dispute over who controls the Ogden desert. The rules applied to arrive at these inferences are listed below:

The triangle inference rules triggered by changes in the base are:

(1) If  $d1$  is not  $= d2$  then either X or Y must have PETITIONed or INVOKed  $\leftarrow$ s- Strength RECENTLY to unbalance a previously isosceles triangle.

(2a) If  $X \leq d1$  DO RESULT in  $d1 > d2$ , then expect  $Y \leq d2$  DO RESULT in (probably) new  $d2 = d1$  or (less likely) new  $d2 > d1$ .

(2b) Same as 2a reversing the roles of X & Y, and  $d1$  &  $d2$ .

(3a) If  $X \leq d1$  DO RESULT in  $d1 < d2$ , then expect  $Y \leq d2$  DO RESULT in (probably) new  $d2 = d1$  or (less likely) new  $d2 < d1$ .

(3b) Same as 3a reversing the roles of X & Y, and  $d1$  &  $d2$ .

Rules 1 - 3 express a balance principle in socio-political relations, to wit: Expect others to treat you as you choose to treat them. Rules 2 and 3 can be used to understand the escalation of a DISPUTE. X does something which causes  $d1$  to increase; Y, in turn, responds by making  $d2$  increase a little more than  $d1$ ; X, in turn further increases  $d1$ , etc... This principle is illustrated by a border skirmish escalating into a war, or the arms race between two countries (such as the US-SOVIET Cold War of the fifties). Similarly, if one of two

DISPUTing countries makes concessions reducing the differences between them, then it is likely that the other disputing party may follow up with similar actions.

There are some inference rules that are triggered by the  $h$  and  $r$  parameters:

(4) If  $h > 5$  (normative value) then A can AUTH and ORDER X & Y.

(5) If  $h < 5$  then A can only AUTH. X and Y may not respect the DECREE of the AUTH. (e.g. A DECREE AUTHed by the UN General Assembly is often ignored by the recipient countries.)

(6) If  $h > 8$  then when A ORDERs X and Y have no alternative action.

(7) If  $r > 5$  then if M is invoked it is likely to RESOLVE the DISPUTE.

(8) If  $r < 5$  then if M is invoked it may NOT RESOLVE the DISPUTE.

These inference rules from a static triangle structure are predictive in nature. There are also inference rules which are triggered from patterns matched by temporal progressions of triangles, for example: If X and Y are moving closer to each other, and Y and Z are drifting apart, then expect X and Z to also drift apart. This rule incorporates the sayings: "Friends of my enemies shall become my enemies." and "Enemies of my friends shall become my enemies." We can apply the rule to interpret the disputes involving Ethiopia, Somalia and Russia:

Russia and Somalia were at Peace ( $d = 5$ ). Russia allied itself with Ethiopia ( $d < 5$ ). Ethiopia and Somalia started fighting a war ( $d = 10$ ). Our rule would predict that relation between Somalia and Russia would worsen ( $d > 5$ ). This is indeed exactly what is happening at the time of this writing.

#### 8. Conclusion

In general, there are two classes of criticisms that are likely to be levelled at what we have presented here. First, there are those that will say that we are backing down from our original position that the eleven primitive ACTs would handle all of English. What we have presented can be considered an indication that eventually we will have all (or many of) the words in a language as the so-called primitives and that our system will look no different than anybody else's system.

The second criticism that we can envision is that the primitives we have constructed here are "ad hoc" and that we give no selection procedure for finding them or any good evaluation procedure for rejecting them.

The reason these criticisms are easily foretold is that they are the same criticisms we have been receiving on previous work for the last ten years. Now let us proceed to some answers.

How many primitives are enough? We have never believed that the eleven primitive ACTs were necessarily the optimal method of description for every domain. It is often necessary to describe

events at the level of the original 11 primitive acts of CD. In fact, nearly all the social ACTs presented in this paper are describable at that level, but that description is neither optimal nor does it capture the important aspects highlighted by the social ACTs. We shall need a new set of primitives for each new general domain we seek to describe. For instance, it is doubtful that Chemistry or Microbiology text would best be represented using any system of primitives that we have so far developed. This does not mean that these domains might not be described by some set of primitives. There very likely are such sets. We have never proposed that the original eleven primitives were going to work for everything. Our position has always been that primitives were necessary, not that any particular set was necessary. (This position is further amplified in Schank and Abelson (1977) where yet another set of primitives useful for describing plans and goals (that is intentions) are elaborated.

This discussion leads us to the second criticism. Where do we stop? How do we know when we have them all? Won't we just have all the words in the language? Isn't what we are doing ad hoc?

It seems obvious to us, that if one wants to describe a domain, one goes about it by looking for the concepts in that domain that serve to organize the most information. For each domain then, there should be some set of primitives. When all the domains are finished, we will have no need for more organizing primitives. In that sense then, our primitives are



"ad hoc". We do create them for each situation. As long as a situation is defined broadly enough to be interesting and as long as the primitives designed for a situation are reusable we have done what is necessary.

Artificial Intelligence is a strange business. We are in the position of attempting to codify all the knowledge of the world. Sometimes this knowledge is best encoded from the point of view of the expert. However, in our research (ordinary text understanding) we have had to rely on the point of view of the usual reader of the text. This means trying to assess what he knows and how he has organized it. It is our belief that the best way to get at such knowledge is to forge ahead by creating primitives, and subsequently testing those primitives for their use as the basis of inference rules and as a basis for the development of understanding programs. We are currently working on developing a system of computer programs to understand newspaper headlines and stories based on the social ACTs and their respective inference rules.



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